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## THE WÜRM BEDS OF THE COAST OF GERONA (SPAIN) \*\*

KEY WORDS: Mollusca, fossil, Würm beds, Gerona (Spain).

### Summary

In this work I expose the Würm species that I have picked up during 1979 along the coast of Gerona. I also put the number of specimens to show the most common species. I indicate the precise place of these beds along the above mentioned coast.

### Resumen

En este trabajo expongo las especies fosiles del periodo Würm que he recogido en la costa de Gerona a lo largo del año 1979. Asimismo incluyo el número de ejemplares encontrados para indicar las especies más abundantes. También localizo con toda perfección el lugar exacto de estos yacimientos fósiles.

### Riassunto

In questo lavoro vengono elencate le specie fossili del periodo Würm, raccolte lungo le coste di Gerona (Spagna) durante il 1979, corredando l'elenco con il numero degli esemplari per mettere in evidenza le specie più abbondanti. Inoltre viene fornita la localizzazione esatta di questi giacimenti fossili.

### Introduction

The coast of Gerona is situated at the northeast point of the Iberian peninsula. At the north, it limits with the French border, and at the south with the coast of Barcelona. The coast we are dealing with is also called « Costa Brava (rough coast) ».

Watching the bottom relief we can see three canyons or « recs » breaking the surface of the plate (Fig. 1). At the north, there is the Cap de Creus rec, at the middle, the Palamós rec o La Fonera rec, and at the south the Blanes rec.

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\*\* Lavoro accettato il 16 gennaio 1981.

At the edges of these recs or canyons the Würm fossil beds are situated, because streams do not allow settlement of quaternary sediments. These streams come out of the inside of the recs.

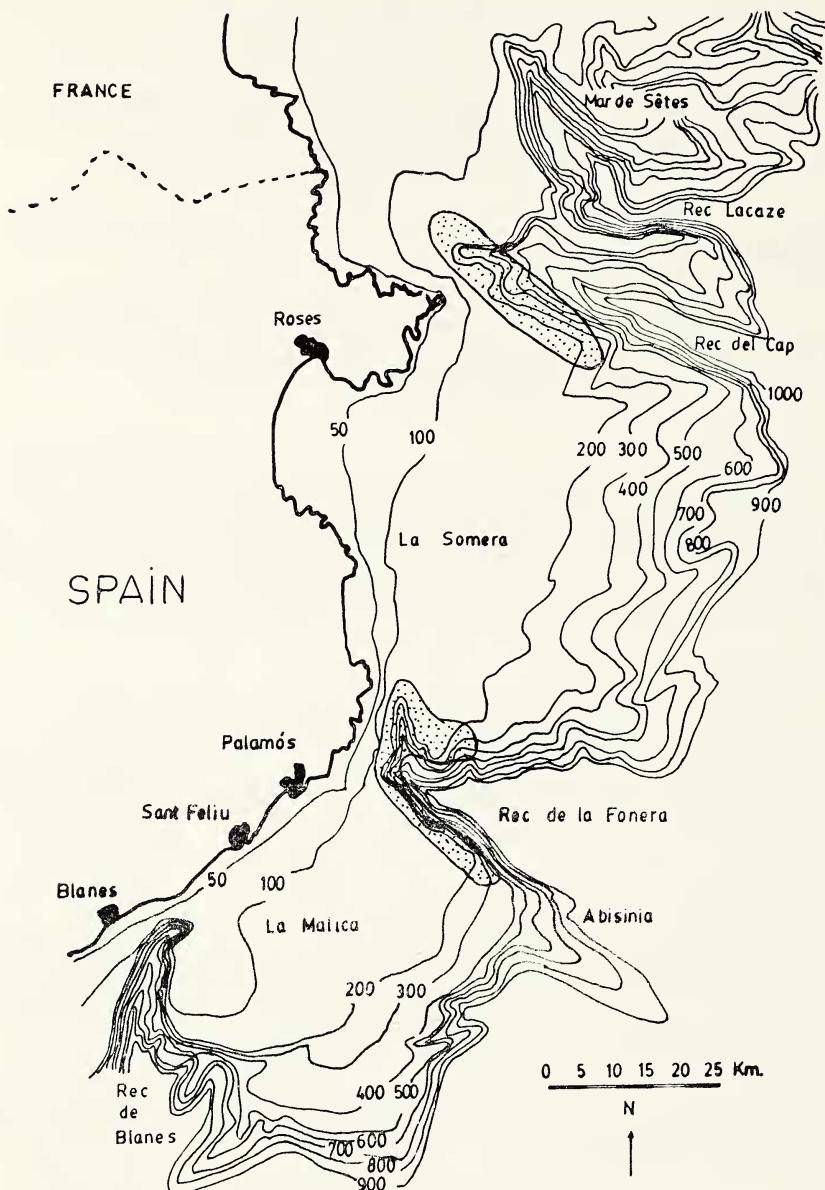


Fig. 1 - Scheme of underwater relief. Names are those of fishing areas; depth in meters; pointed areas are Würm beds.

The edges of the mentioned recs are actually graveyards of shells. On Fig. 1 you can see the exact place of these beds (pointed areas).

I do not study the Blanes rec, but I suppose it also has a Würm shells bed.

Sometimes you can pick up these shells on the plate, because fishermen throw them away while cleaning their nets.

## Materials and methods

I have used trawlers to gather specimens. Sometimes trawling fishermen work near Würm beds and then they pick them up.

I did this work in 1979. I have picked up samples twice a month from each bed, so that I could set a sample with enough accuracy.

## Results

At the moment there are only few works about these beds of this coast (PRUVOT & ROBERT, 1897; MARS, 1957 and 1958; and MARTINELL-JULIA BRUGUES, 1973).

MARS cited in his work the following species:

- *Haliotis lamellosa* LAM.
- *Gibbula magus* L.
- *Calliostoma zizyphinum* L.
- *Astraea rugosa* L.
- *Turritella tricarinata* BR.
- *Turritella turbona* MTS.
- *Capulus hungaricus* L.
- *Polynices catena* DA COSTA.
- *Polynices fusca* BLAINVILLE.
- *Polynices pallida* BROD.
- *Aporrhais pespelecani* L.
- *Phallium saburon* BRUG.
- *Pseudomurex lamellosus* J.
- *Hadriania brocchii* MTRS.
- *Sipho fusiformis* BROD.
- *Sipho ebur* MORCH.
- *Neptunea sinistrosa* DESH.
- *Buccinum undatum* L.
- *Buccinum groenlandicum* CH.
- *Nassa reticulata* L.
- *Dentalium inaequicostatum* DTZ.
- *Nucula nucleus* L.
- *Nucula sulcata* BORN.
- *Arca diluvia* LMK.
- *Arca barbata* L.
- *Glycimeris glycimeris* L.
- *Mytilus edulis* L.
- *Modiolus modiolus* L.
- *Pecten jacobaeus* L.
- *Chlamys islandica* MUL.
- *Chlamys opercularis* L.
- *Chlamys multistriata* POLI.
- *Chlamys septemradiata* MUL.
- *Chlamys clavata* POLI.
- *Chlamys pectalis* L.
- *Monia patelliformis* L.
- *Monia glauca* MTRS.
- *Ostrea edulis* L.
- *Astarte fusca* POLI.
- *Astarte sulcata* DA COSTA.
- *Cyprina islandica* L.
- *Isocardia humana* L.
- *Miltha borealis* L.
- *Cardium glaucum* BRUG.
- *Cardium tuberculatum* L.
- *Cardium aculeatum* L.
- *Cardium echinatum* L.
- *Cardium aculeatum* L.
- *Laevicardium oblongum* CH.
- *Laevicardium crassum* GM.
- *Venus casina* L.
- *Venus effosa* BIV.
- *Venus gallina* L.
- *Venus fasciata* DA COSTA.
- *Venus ovata* PEN.
- *Pitaria rufa* POLI.
- *Pitaria chione* L.
- *Tapes rhomboides* PEN.
- *Dosinia exoleta* L.
- *Dosinia lupinus* POLI.
- *Gouldia minima* MTG.
- *Mactra corallina* L.
- *Mactra glauca* BORN.
- *Spisula subtruncata* DA COSTA.
- *Spisula solidia* L.
- *Spisula elliptica* BROWN.
- *Lutraria lutraria* L.
- *Lutraria oblonga* CH.
- *Arcopagia crassa* PEN.
- *Macoma calcarea* CH.
- *Psammobia depressa* PEN.
- *Zozia antiguata* PULT.
- *Ensis ensis* L.
- *Saxicava pholadis* L.
- *Panomya arctica* LAM.
- *Mya truncata* L.
- *Corbula gibba* OL.
- *Thracia pubescens* PULT.

MARTINELL-JULIA BRUGUES dated only a few samples:

- *Sipho curtus* JEFFREYS, 1867.
- *Neptunea contraria sinostrosa* DESHAYES, 1830.
- *Buccinum undatum* LINNEO, 1758.
- *Buccinum humphreysianum* BENNET, 1825.
- *Modiolus modiolus* LINNEO, 1758.
- *Chlamys islandica* MÜLLER, 1776.
- *Pseudamussium septemradiatus* MÜLLER, 1779.
- *Artica islandica* LINNEO, 1767.
- *Panomya norvegica* SPENGLER, 1793.

In the table 1 we can see the Würm fossil species I have found. Numbers indicate the amount I have gathered. I do not enclose a list of living species because it is subject of another work I presented in september 1980 in Perpignan at the VII Congrès de Malacologie.

I have not found all species that MARS found. I do not know if MARS confused living species with Würm ones. However I cite many species that MARS dated.

If we observe the quantities we can see that the more abundant samples are the species found by MARTINELL-JULIA BRUGUES' work.

Gastropod prosobranchia shells usually are associated with hermit crabs of genus *Pagurus* and with anemones *Calliactis parasitica* COUCH and *Adamsia palleata* BOHADSCH.

## Discussion

At first we can see that there are several extinguished species from the Mediterranean sea, which now they live in cold water seas (North sea, Iceland sea ...).

These species are:

- *Neptunea contraria* LINNEO, 1771
- *Buccinum undatum* LINNEO, 1758
- *Buccinum humphreysianum* BENNET, 1825
- *Modiolus modiolus* LINNEO, 1758
- *Pseudamussium septemradiatum* (MÜLLER, 1776)
- *Chlamys islandica* MÜLLER, 1776
- *Arctica islandica* (LINNEO, 1767)
- *Panomya norvegica* SPENGLER, 1793

These species confirm the theory of colder temperature in the Mediterranean sea in Würm time. For this reason they are called « cool fauna ».

Comparing depths of these species we note that now they live between 0 - 150 meters deep and the Würm bed is placed 200 - 400 meters deep. This characteristic points out that the sea level was near 100 meters lower.

Table 1 - List of the species picked up; numbers show quantity of each one.

Species	Cap Creus bed	Palamós bed
<b>PROSOBRANCHIA</b>		
<i>Calliostoma zizyphinus</i> (LINNEO, 1758)	0	1
<i>Calliostoma granulatum</i> (BORN, 1778)	0	2
<i>Turritella turbona</i> MONTEROSATO, 1877	0	1
<i>Capulus ungaricus</i> (LINNEO, 1758)	14	31
<i>Lunatia fusca</i> (BLAINVILLE, 1825)	4	18
<i>Ranella gigantea</i> LAMARCK, 1816	0	4
<i>Coralliphila lamellosa</i> PHILIPPI, 1826	3	1
<i>Colus gracilis</i> (DA COSTA, 1778)	1	33
<i>Neptunea contraria sinostrosa</i> DESH., 1830	4	8
<i>Buccinum undatum</i> LINNEO, 1758	49	119
<i>Buccinum humphreysianum</i> BENNET, 1825	32	64
<b>OPISTHOBRANCHIA</b>		
<i>Scaphander lignarius</i> (LINNEO, 1758)	0	1
<i>Bulla striata</i> BRUGUIERE, 1789	0	11
<b>BIVALVIA</b>		
<i>Diluvarca diluvii</i> (LAMARCK, 1805)	3	1
<i>Modiolus modiolus</i> LINNEO, 1758	12	8
<i>Pseudamussium septemradiatum</i> (MÜL., 1776)	56	89
<i>Peplum clavatum</i> (POLI, 1795)	1	10
<i>Aequipecten opercularis</i> (LINNEO, 1758)	3	3
<i>Chlamys islandica</i> MÜLLER, 1776	44	128
<i>Pecten jacobaeus</i> (LINNEO, 1758)	1	1
<i>Monia patelliformis</i> (LINNEO, 1767)	0	2
<i>Ostrea cochlear</i> (POLI, 1795)	584	145
<i>Glossus humanus</i> (LINNEO, 1758)	151	53
<i>Arctica islandica</i> (LINNEO, 1767)	128	142
<i>Chama gryphoides</i> LINNEO, 1758	1	0
<i>Laevicardium oblongum</i> (GMELIN in L., 1791)	0	6
<i>Acanthocardia echinata</i> (LINNEO, 1758)	171	11
<i>Pitar rudis mediterranea</i> (TIBERI, 1855)	0	11
<i>Globivenus effossa</i> (ANT. BIVONA in PHILIPPI, 1836)	1	2
<i>Circomphalus casinus</i> LINNEO, 1758	0	14
<i>Dosinia exoleta</i> (LINNEO, 1758)	0	1
<i>Venerupis rhomboides</i> (PENNANT, 1777)	0	1
<i>Panomyia norvegica</i> (SPENGLER, 1793)	14	65

Observing the number of species we can deduce their abundance. The more typical species are:

- *Capulus ungaricus* (LINNEO, 1758)
- *Buccinum undatum* LINNEO, 1758
- *Buccinum humphreysianum* BENNET, 1825
- *Ostrea cochlear* (POLI, 1795)
- *Pseudamussium septemradiatum* (MÜLLER, 1776)
- *Chlamys islandica* MÜLLER, 1776
- *Glossus humanus* (LINNEO, 1758)
- *Acanthocardia echinata* (LINNEO, 1758)
- *Arctica islandica* MÜLLER, 1776
- *Panomya norvegica* (SPENGLER, 1793)

Nowadays, as a remembrance of this cool fauna, *Buccinum humphreysianum inflatum* ARADAS & BENOIT, 1870 and *Glossus humanus* (LINNEO, 1758), stay in the Mediterranean sea.

We find more species at the Palamós bed than in that of Cap de Creus. That may be due to the sampling method. Specimens that were usually picked up at Palamós and with rarity at Cap de Creus are:

- *Colus gracilis* (DA COSTA, 1778)
- *Ranella gigantea* LAMARCK, 1822
- *Bulla striata* BRUGUIERE, 1789
- *Peplum clavatum* (POLI, 1795)
- *Laevicardium oblongum* (GMELIN in L., 1791)
- *Pitar rudis mediterranea* (TIBERI, 1855)
- *Circomphalus casinus* LINNEO, 1758

## Acknowledgments

I wish to thank the great help I have received from the fishing trawlers BAIX EMPORDÀ of Palamós and TRAMONTANA III of Roses without which I could not have carried out the sampling.

## REFERENCES

- MARTINELL - JULIA BRUGUES, 1973 - Nuevos datos sobre los yacimientos Würmienses del litoral catalán. *Acta Geológica Hispánica*, 8 (3) : 105-108.  
MARS P., MATHELY J. and PARIS J., 1957 - Remarques sur le gisement sousmarin quaternaire de Cap de Creus. *C.R. Acad. Sci. n.* 242 pp. 1940.  
MARS P., 1958 - Les faunes malacologiques quaternaires « froides » de Méditerranée. Le gisement du Cap de Creus. *Vie et Milieu* 9 (3) : 293-309.  
PRUVOT G. and ROBERT A., 1897 - Sur un gisement sousmarin de coquilles anciennes au voisinage du Cap de Creus. *Arch. Zool. Expér. et Gén.* III-V : 497-510.